Remarks

In the Office action dated July 16, 2003, the Examiner rejected claims 1-19 under 35 U.S.C. § 103 as being unpatentable over the U.S. patent to Telschow, et al. 6,134,006 in view of the U.S. Patent to Hashima, et al. 5,521,843.

By these remarks Applicants' Attorney respectfully traverses the Examiner's rejection under 35 U.S.C. § 103 for the following reasons.

Briefly, the present invention relates to a cost-effective method and system for measuring the vibration of an object. The word "vibrate" suggests rapid, regular, back and forth motion. The claimed invention requires the use of calibration data which is processed together with a plurality of signals (such as from a camera) to obtain the vibration measurement of the object. The calibration data is based on a correlation of a change in distance between substantially coplanar, spaced-apart marks to physical movement of the object. In other words, the calibration data, which is processed with the plurality of signals, is a function of a correlation of a change in distance between the spaced-apart marks and physical movement of the object. Vibration of the object is measured by processing the calibration data with the plurality of signals. Clearly, such clearly defined and claimed calibration data and the processing of such calibration data with a plurality of signals to obtain a vibration measurement is neither taught, disclosed nor discussed by any of the prior art of record taken either alone or in combination with one another.

For example, the U.S. Patent to Telschow, et al. discloses a relatively costly vibration measurement method and system using light interference of light beams of different frequencies. In particular, Telschow, et al. discloses a method and system for imaging vibrations across an object surface by collecting laser light that is scattered from the surface. By mixing the scattered light from the object with a modulated reference beam inside a photorefractive material, an optical lock-in detection technique is achieved through narrow bandwidth signal processing. Such an apparatus and method achieves a subnanometer surface displacement sensitivity.

As noted at column 6, lines 38-42 of Telschow, et al. calibration measurements are implemented using a piezoelectric translation mirror wherein the excited vibrational modes of the specimen determine the frequency-dependent displacement amplitude of the surface which is transferred into a phase modulation of the object beam. Clearly, such calibration is different from the calibration of the present invention.

In other words, Telschow, et al. fails to disclose calibration data which is based on a correlation of a change in distance between spaced-apart marks on an object to physical movement of the object. Furthermore, Telschow, et al. fails to disclose processing of such calibration data with a plurality of signals to obtain a vibration measurement of the object.

The U.S. Patent to Hashima, et al. (cited on page 2 of the specification) discloses a method and system for recognizing and tracking a target mark on an object with a video camera. Hashima, et al. are not concerned with measuring the vibration of an object. Rather, it is concerned with determining position for use by a robot. In one embodiment, the target mark comprises a black circle and a wide triangle mounted centrally on the black circle and 3-D shifted from the black circle. The method and system are provided for detecting the position and attitude of the target mark for processing an image of the target mark and detecting a shift of the position of the target mark from a predetermined position. The position and attitude of the object are measured. A detected value representing the area of the target mark in the image is related to the distance between the video camera and the target mark in the first embodiment.

In another embodiment, a target mark includes a circle and its central point. The position and attitude of the circle in three-dimensional space is uniquely determined from projected images of the circle and its central point. Two points S and T that define a diameter parallel to the image plane on the target mark are determined in accordance with the central point and are determined from a ratio between the distance between the image points in the image plane and a diameter of the circle.

In yet another embodiment, positions of the center of gravity of four disk-shaped marks on an object are determined. The four point perspective problem is then solved to calculate the distance to the object.

Hashima, et al. recognizes the need for calibration only at column 21, lines 10-12. However, this need for calibration has nothing to do with the calibration data of the present invention which is processed together with signals to obtain a vibration measurement.

None of the embodiments described in Hashima, et al. describe processing calibration data with a plurality of signals to obtain a vibration measurement wherein the calibration data is based on a correlation of a change in distance between spaced-apart marks to physical movement of the object.

Furthermore, it is respectively submitted that there is no suggestion to combine the target marks of Hashima, et al. with the relatively sophisticated and costly method and system of Telschow, et al. Telschow, et al. require that the laser light be scattered from a surface of the object and not from a target marker.

Consequently, in view of the above and in the absence of better art Applicants' Attorney respectfully submits the application is in condition for allowance which allowance is respectfully requested.

Respectfully submitted,

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